Preferred Dates: July 24th - 28th Description: Basic Design, Sketch, and Inventor Skills

Class name: The Puzzle Cube Project
Age Group: Grades 3 - 8

Resources Needed:

- Venue
- Computers
    - with Autodesk Inventor installed
- Folders
- Isometric Graph paper
    - (can be printed off) aka orthographic grid paper
- Projector
    - for ease of lesson explanations and demonstrations?
- Mathlink cubes (ideal)
    - or dice with double sided tape
- Wooden blocks
- Glue
- Fruit Snacks and other snack-type foods?

Lesson Plans
Class time: 9:00 am to 3:00 pm

Day	Plan
1	➢ 9:15 - Icebreaker/Personal Introduction ➢ 9:45 - Intro to the design process ○ The design process (Method to solve a problem or create a new product) is a cornerstone of all engineering professions. Every engineer must generate concepts, prototype, etc. ➢ 10:15 - Instant design challenge ○ Aerodynamic distance ■ Design something in groups of four (using only certain supplies) that will cover the most distance when thrown. Be creative and the team with the best design gets candy ➢ 11:30 - Lunch break ➢ 12:10 - Folders (Engineering Portfolios for the kids) and introduction to the puzzle cube project.

	○ Create an example and explain what the project is and what they need to accomplish in the week-long period ■ Criteria and Constraints (pieces must be at least four blocks, there must be five pieces per 3 by 3 puzzle cube, etc.) ➢ 12:30 - Introduction to sketching and different types of sketches ○ Perspective sketches ○ Isometric sketches ○ Dimensioned drawings ○ Multiviews ➢ 1:00 - Snack break ➢ 1:15 - Students sketch puzzle cube piece designs on isometric graph paper ○ At least 30 total puzzle cube piece possibilities ■ Rec: at least ten ideas for four cubes, five, and six ■ Use mathlink connecting cubes for visual aid if necessary ➢ 3:00 - Parents arrive and kids put work in their portfolio folders and leave them
2	➢ 9:15 - Using the puzzle part options generated on day one, create two different puzzle cube designs with ten unique parts ○ Let them use Mathlink cubes to create the pieces they sketches and two complete puzzle cube solutions ■ One design should be simpler to solve and the other more difficult. Note that, generally, more interlocking pieces make for a more difficult puzzle cube ➢ 11:30 - Lunch Break ➢ 12:10 - For each design, kids will neatly sketch and color code an isometric view of each of the five parts and show how they fit together in an isometric view of the cube ○ Show examples ➢ 1:30 - Snack Break ➢ 1:45 - Kids will choose the best design from the two options and document reasons for their choice and then create multi-view drawings of each of their five puzzle pieces for their selected design on orthographic grid paper. ○ Carefully select the best front view and include ALL object and hidden lines. Show the minimum number of orthographic projections necessary to show all details of the part ➢ 3:00 - Parents Arrive and students leave all work in portfolio folders.
3	➢ 9:15 - Review sketches with a partner or continue to work on them ○ Is the chosen front view the best front view? ○ Were the minimum number of orthographic projections used to represent each part?

	○ Are all the orthographic projections oriented properly to each other? ○ Are all the object lines and hidden lines shown properly? ➢ 10:15 - Begin introduction to Inventor ○ Demonstrate how to create project files and create a piece example while explaining simple geometric/ dimensioning constraints, and extrusions. Show them how to change the color of the piece ➢ 11:30 - Lunch Break ➢ 12:10 - Let students work in Inventor and create their pieces ➢ 1:30 - Snack Break ➢ 1:45 - Resume Inventor work time ○ Make sure they SAVE their work ➢ 3:00 - Parents arrive and students leave work in portfolio folders
4	➢ 9:15 - Introduction to creating an Inventor assembly ○ Demonstrate how to constrain pieces to each other and assemble a cube ➢ 9:35 - Students work on their own puzzle cube assemblies ➢ 11:30 - Lunch break ➢ 12:10 - Demonstrate how to create dimensioned drawings in Inventor ○ Show examples ➢ 12:30 - Students create dimensioned drawings of puzzle cube pieces and their finished assembly ○ Create a parts list with numbered balloons for puzzle cube assembly page, and show every side of cube ➢ 1:30 - Snack break ➢ 3:00 - Parents arrive and students leave work in portfolio folders
5	➢ 9:15 - Students print their drawings and neatly put together their work in their portfolio folders in order of the design process ○ Piece concept sketches first, then solution sketches, etc. ➢ 10:00 - Students are given wooden blocks and glue so they can create their puzzle cube pieces ○ Kids must write their names on every piece ➢ 11:30 - Lunch break ○ Waiting for glue to dry ➢ 12:10 - Assemble your puzzle cube and color your pieces (if you want to) ○ Kids can exchange their puzzles and try to solve each other's cubes ➢ 1:30 - Special last day snack? ➢ 3:00 - Parents arrive and students take home their cubes and their folders